

# SPECTRO Series

## ► SPECTRO-3-FIO-VISUV

- Detection of fluorescent marks and colors marks (e.g. black, magenta, cyan, and yellow)
- Two adjustable light sources (Double Light Source)
- Measuring range typ. 1 mm ... 500 mm (depends on fiber optics, light source, and attachment optics)
- Various UV light conducting fiber optics available
- Insensitive to outside light due to modulated UV LED ( AC-operation)
- Brightness correction can be activated (STAT/DYN)
- Scan frequency max. 30 kHz (DC- or OFF-operation)
- Switching frequency typ. 30 kHz
- RS232 interface (USB or Ethernet adapter is available)
- Several TEACH functions (via PC, PLC, or push button)
- Various evaluation algorithms can be activated
- "BEST HIT" mode ("human color assessment")
- Switching state display by means of 5 yellow LEDs
- Temperature compensated
- Averaging can be activated (from 1 up to over 32000 values)
- 3-color filter detector (true color detector: "human color perception")
- Possibility for connection of external UV light source SPECTRO-3-ELS-UV (365 nm), enables mixing of white light (internal light source) and UV light



### Design

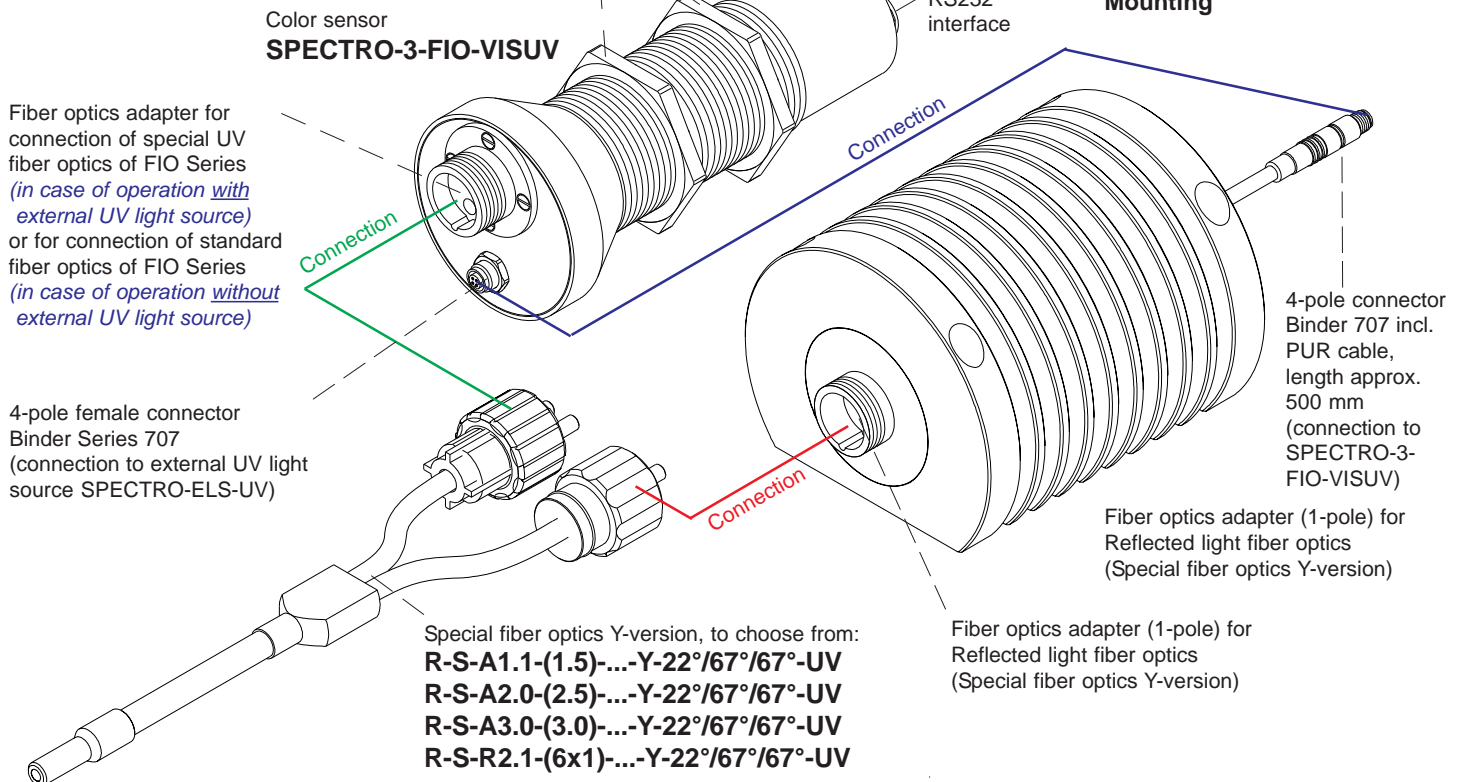
#### Product name:

**SPECTRO-3-FIO-VISUV**  
(incl. Windows® PC software  
SPECTRO3-DLS-Scope)

Sturdy aluminium housing,  
anodized in blue

**Accessories:** (p. 13-17)

**External UV light source**  
**Special fiber optics (Y-version)**  
**Attachment optics**  
**Mounting**





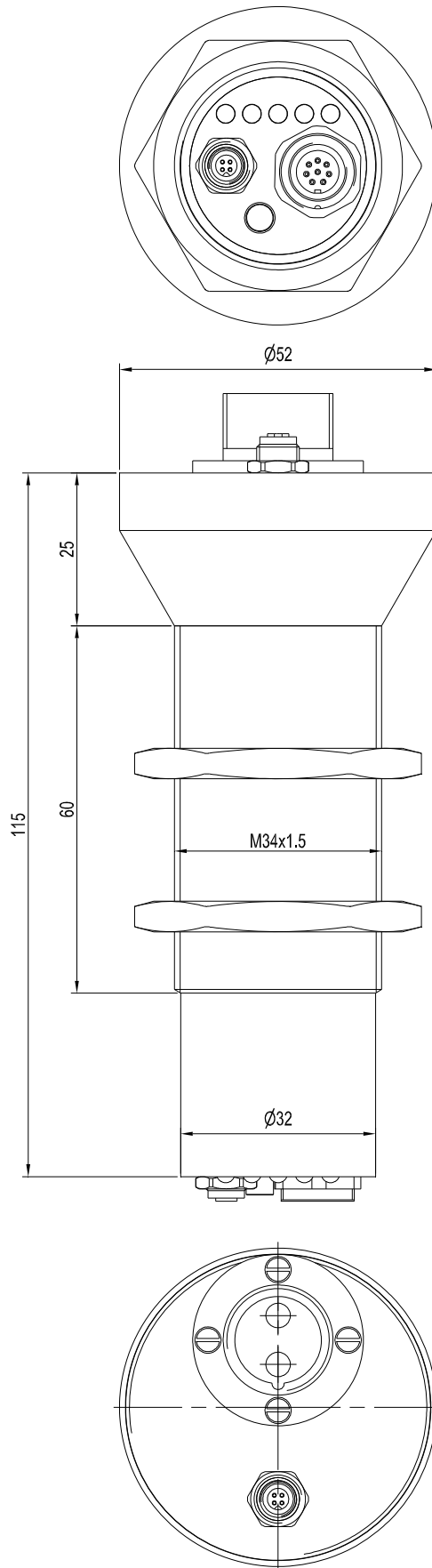
**Technical Data**

| Model                             | SPECTRO-3-FIO-VISUV   |
|-----------------------------------|---|
| Voltage supply                    | +24VDC ( $\pm 10\%$ ), reverse polarity protected, overcurrent protected  |
| Current consumption               | < 320 mA  |
| Max. switching current            | 100 mA, short circuit proof   |
| Switching state indication        | 5 yellow LED visualize the physical state of the outputs OUT0 ... OUT4  |
| Input digital (1x)                | IN0 (Pin 3), digital (0V/+24V) or teach button at the housing   |
| Outputs digital (5x)              | OUT0 ... OUT4 (Pin 4 ... 8): digital (0V/+24V), npn/pnp-able (bright/dark-switching, can be switched)   |
| Interface                         | RS232   |
| Pulse lengthening                 | 0 ... 100 ms, adjustable via PC software  |
| Averaging                         | max. 32768 values, adjustable via PC software   |
| Scan frequency                    | LED operation, can be switched via PC software:<br>AC operation: max. 10 kHz (depends on parameterization)<br>DC operation: max. 30 kHz (depends on parameterization)   |
| Switching frequency               | typ. 30 kHz   |
| Transmitter (light source)        | super-bright white-light LED or external UV light source SPECTRO-ELS-UV (365 nm)  |
| Transmitter control               | can be switched via PC software:<br>AC operation (LED MODE-AC), DC operation (LED MODE-DC)  |
| Object distance (measuring range) | with reflected light fiber optics: typ. 1 mm ... 500 mm (depends on fiber optics and attachment optics)<br>with transmitted light fiber optics: typ. 10 mm ... 500 mm (depends on fiber optics and attachment optics) |
| Receiver                          | 3-color filter detector (TRUE COLOR detector, "human color perception"), color filter curves acc. to CIE 1931   |
| Receiver gain setting             | 8 steps (AMP1 ... AMP8), adjustable via PC software   |
| Ambient light                     | max. 5000 Lux   |
| Size of light spot                | depends on fiber optics and attachment optics (cf. catalog FIO series)  |
| Reproducibility                   | in the X, Y color range each 1 digit at 12-bit A/D conversion   |
| Temperature drift X,Y             | $\Delta X/\Delta T$ ; $\Delta Y/\Delta T$ typ. 0,2 digits/ $^{\circ}\text{C}$ (< 0,01% / $^{\circ}\text{C}$ )   |
| Color difference                  | $\Delta E \geq 0,5$   |
| Color space                       | X Y INT siM (Lab)   |
| Color memory capacity             | non-volatile EEPROM with parameter sets for max. 31 colors  |
| Housing dimensions                | length approx. 115 mm x $\varnothing$ 32 mm (threaded M34x1.5) or $\varnothing$ 52 mm (optics holding device), without connectors   |
| Housing material                  | aluminum, anodized in blue (fiber optics adaptor: aluminum, anodized in black)  |
| Enclosure rating                  | IP64  |
| Connecting cables                 | to PLC: cab-las8/SPS or cab-las8/SPS-w<br>to PC/RS232 interface: cab-las4/PC or cab-las4/PC-w<br>to PC/USB interface: cab-las4/USB or cab-las4/USB-w, to PC/Ethernet interface: SI-RS232/Ethernet-4                   |
| Type of connector                 | connection to PLC: 8-pole fem. connector (Binder 712), connection to PC: 4-pole fem. connector (Binder 707)<br>connection to external UV light source SPECTRO-ELS-UV: 4-pol. fem. connector (Binder 707)              |
| Operating temp. range             | -20 $^{\circ}\text{C}$ ... +55 $^{\circ}\text{C}$   |
| Storage temperature range         | -20 $^{\circ}\text{C}$ ... +85 $^{\circ}\text{C}$   |
| EMC test acc. to                  | DIN EN 60947-5-2  |
| External light source             | possibility of connection of an external UV light source type SPECTRO-ELS-UV, 365 nm  |



Dimensions

Color sensor:  
SPECTRO-3-FIO-VISUV

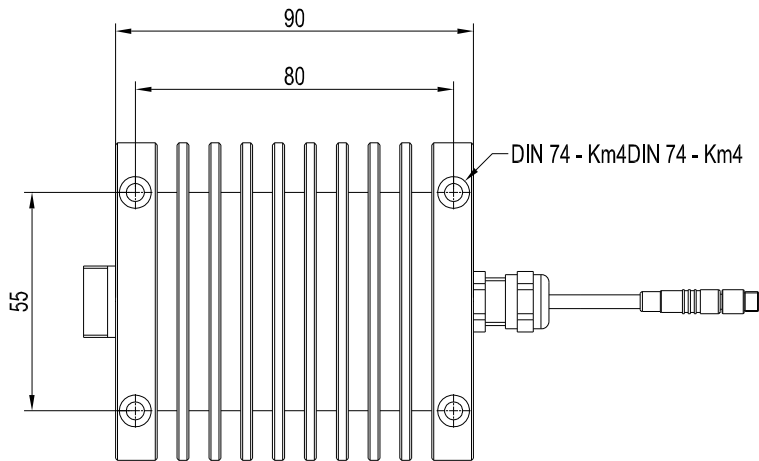
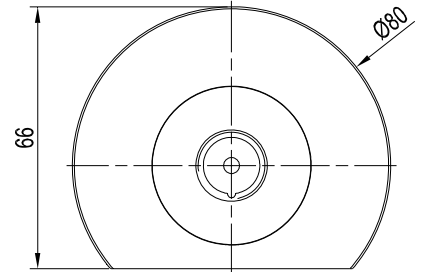
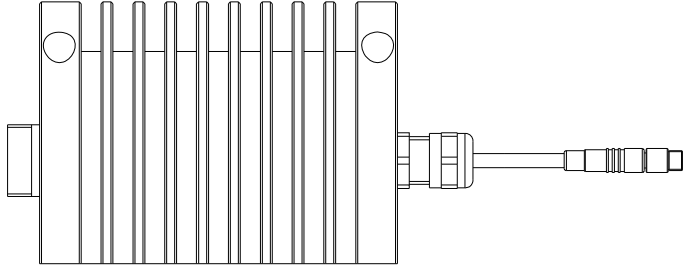


All dimensions in mm



Dimensions

External light source:  
SPECTRO-ELS-UV



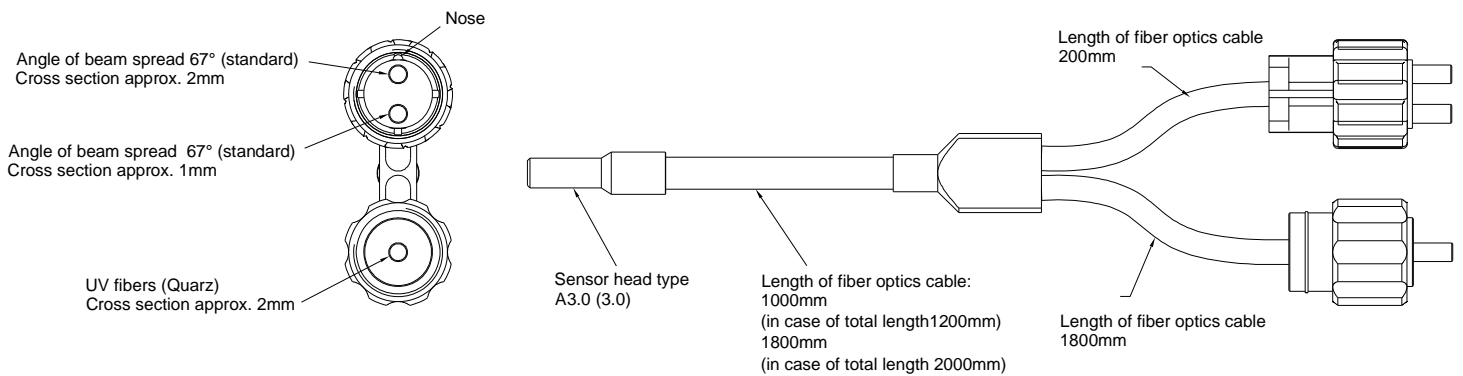
All dimensions in mm

Dimensions

Special fiber optics (Reflected light fiber optics, Y-version)  
for use with external light source SPECTRO-ELS-UV:

- R-S-A1.1-(1.5)-1200-Y-22°/67°/67°-UV
- R-S-A1.1-(1.5)-2000-Y-22°/67°/67°-UV
- R-S-A2.0-(2.5)-1200-Y-22°/67°/67°-UV
- R-S-A2.0-(2.5)-2000-Y-22°/67°/67°-UV
- R-S-A3.0-(3.0)-1200-Y-22°/67°/67°-UV
- R-S-A3.0-(3.0)-2000-Y-22°/67°/67°-UV
- R-S-R2.1-(6x1)-1200-Y-22°/67°/67°-UV
- R-S-R2.1-(6x1)-2000-Y-22°/67°/67°-UV

Example with fiber optics type A3.0:  
R-S-A3.0-(3.0)-(length)-Y-22°/67°/67°-UV



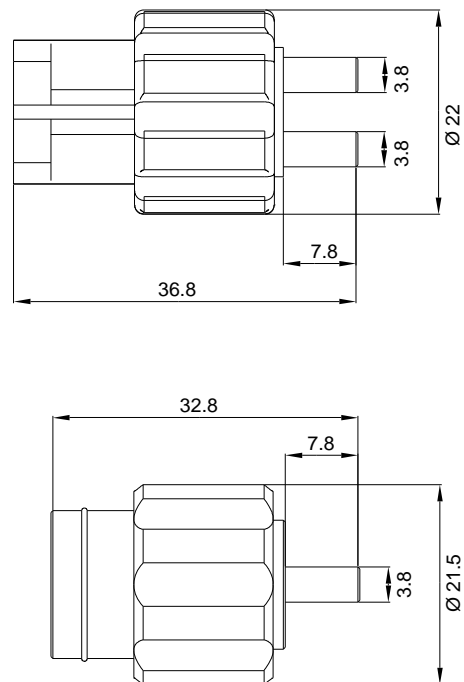
Sensor head type for special fiber optics  
(Reflected light fiber optics, Y-version):

Fiber optics adapter :

**Sensor head type A (End sleeve: Special steel)**

| Typ  | A   | B  | C | D  | E   | F   | ØJ |   |     |
|------|-----|----|---|----|-----|-----|----|---|-----|
|      | Ø   |    |   |    | Ø   | Ø   | P  | M | S   |
| A1.1 | 6,6 | 8  | 2 | 11 | 2,5 | 1,5 | -  | 5 | 4,4 |
| A2.0 | 6,6 | 10 | 2 | 12 | 4,5 | 2,5 | 6  | 6 | 5,8 |
| A3.0 | 8,5 | 11 | 2 | 15 | 6,0 | 3,0 | 7  | 7 | 7,5 |

A1.0 : End sleeve only for PVC-sheathing



All dimensions in mm

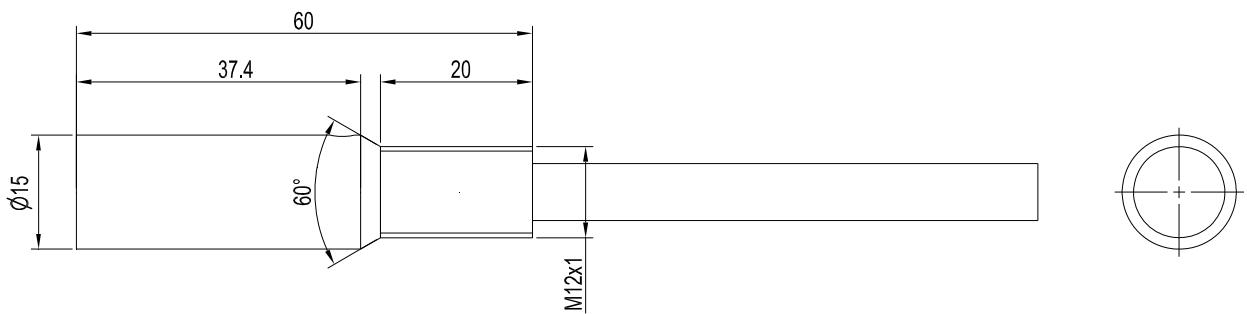


Dimensions

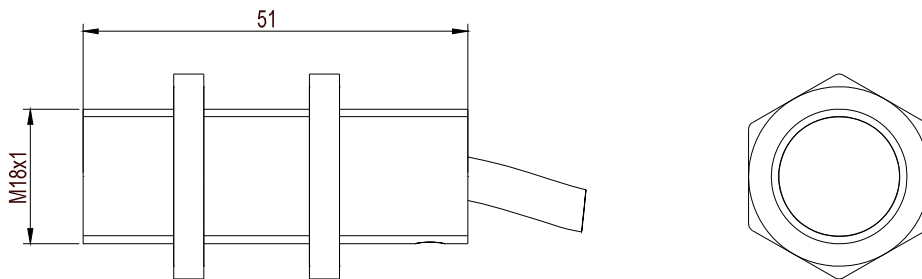
Attachment optics for special UV fiber optics in Y-version (22°/67°/67°-UV)

- KL-3 (A2.0)
- KL-4 (A1.1)
- KL-5 (R1.1)
- KL-8 (R2.1)
- KL-9 (A3.0)
- KL-M18-A1.1
- KL-M18-A2.0
- KL-M18-A3.0
- KL-M18-R2.1
- KL-M34-A1.1
- KL-M34-A2.0
- KL-M34-A3.0
- KL-M18-R2.1

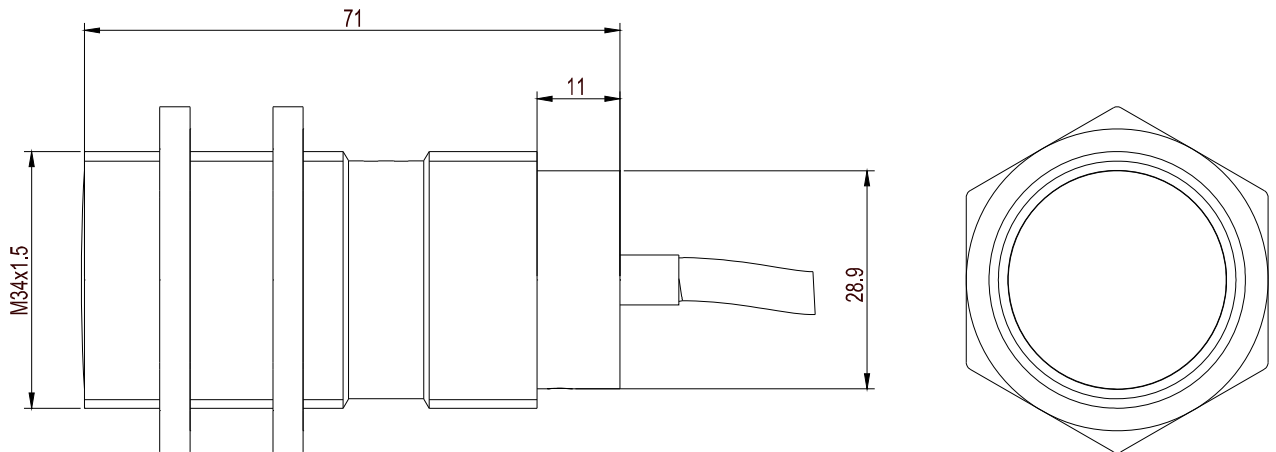
- KL-3
- KL-4
- KL-5
- KL-8
- KL-9



- KL-M18-A1.1
- KL-M18-A2.0
- KL-M18-A3.0
- KL-M34-R2.1

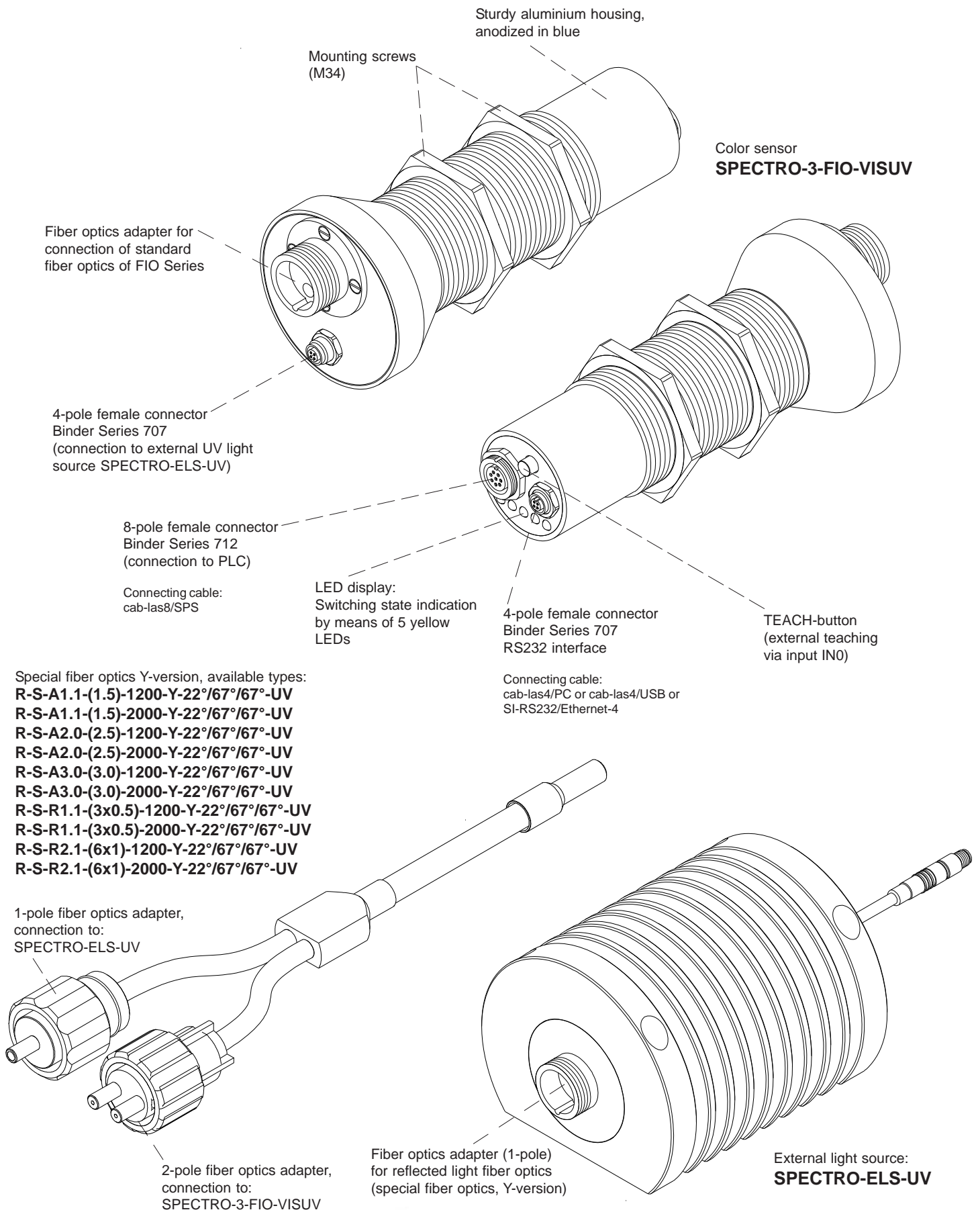


- KL-M34-A1.1
- KL-M34-A2.0
- KL-M34-A3.0
- KL-M34-R2.1



All dimensions in mm

Anschluss



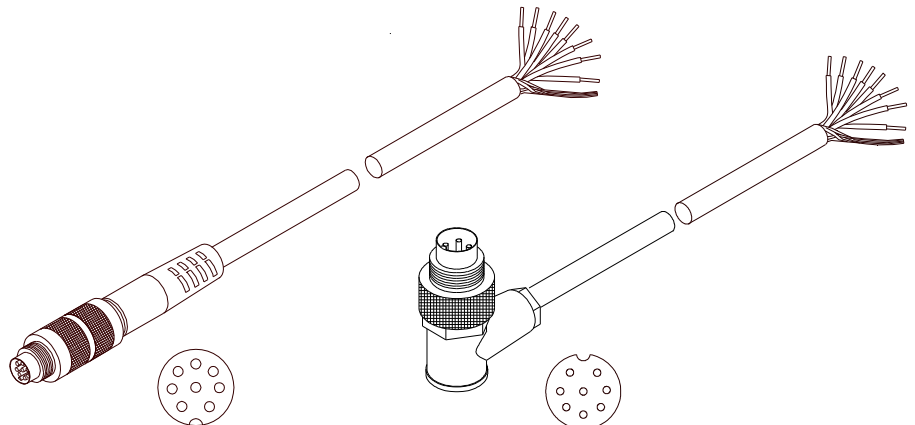


**Connector Assignment**

**Connection to PLC:  
8-pole fem. connector Binder Series 712**

| Pin: | Color: | Assignment:   |
|------|--------|---------------|
| 1    | white  | GND (0V)      |
| 2    | brown  | +24VDC (±10%) |
| 3    | green  | IN0           |
| 4    | yellow | OUT0          |
| 5    | grey   | OUT1          |
| 6    | pink   | OUT2          |
| 7    | blue   | OUT3          |
| 8    | red    | OUT4          |

Connecting cable:  
cab-las8/SPS-(length)  
cab-las8/SPS-w-(length) (angle type, 90°)  
(standard length 2m)



cab-las8/SPS-...  
(max. length 25m, outer jacket: PUR)

cab-las8/SPS-w-...  
(max. length 25m, outer jacket: PUR)

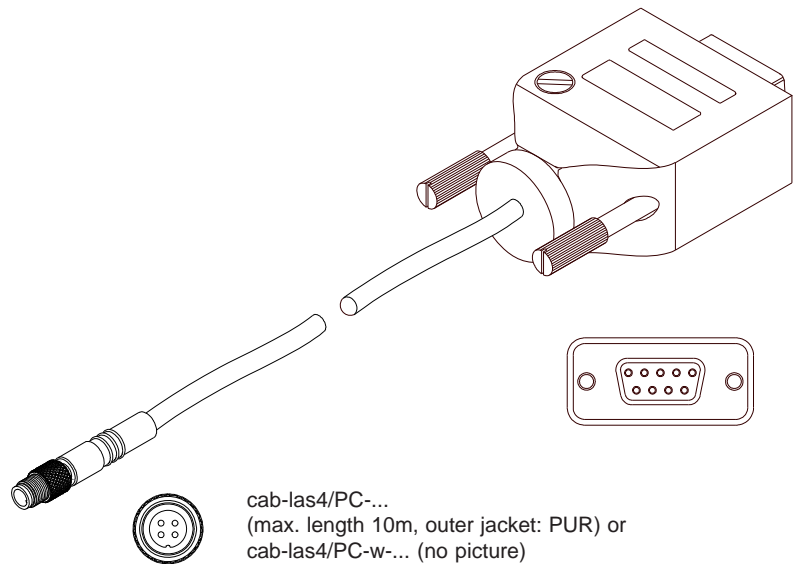
**Connection to PC:  
4-pole fem. connector Binder Series 707**

| Pin: | Assignment:       |
|------|-------------------|
| 1    | +24VDC (+Ub, OUT) |
| 2    | GND (0V)          |
| 3    | RxD               |
| 4    | TxD               |

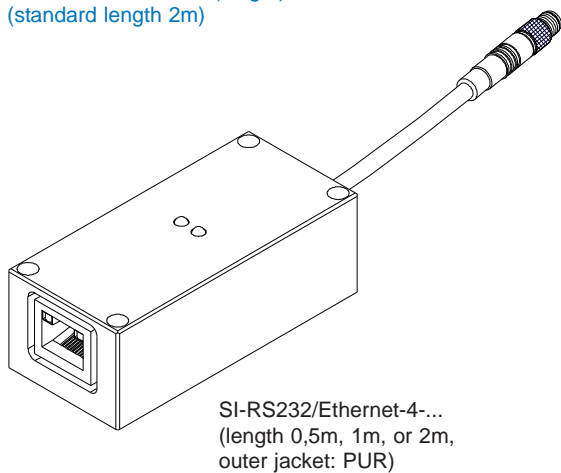
**Connection via RS232 interface at the PC:**  
Connecting cable:  
cab-las4/PC-(length)  
cab-las4/PC-w-(length) (angle type 90°)  
(standard length 2m)

**alternative:**  
**Connection via USB interface at the PC:**  
Connecting cable (incl. driver software):  
cab-las4/USB-(length)  
cab-las4/USB-w-(length) (angle type 90°)  
(standard length 2m)

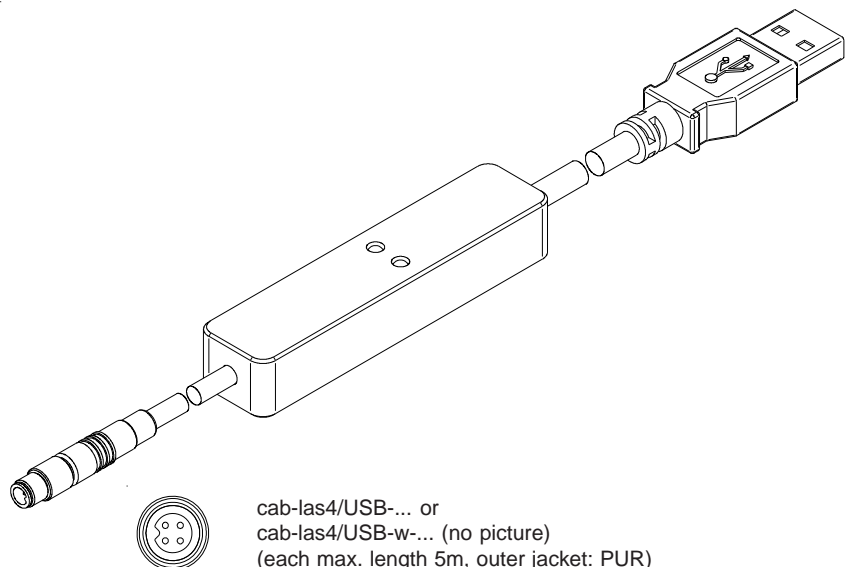
**alternative:**  
**Connection to local network via Ethernet bus:**  
Adapter (based on Lantronix XPortModul):  
SI-RS232/Ethernet-4-(length)  
(standard length 2m)



cab-las4/PC-...  
(max. length 10m, outer jacket: PUR) or  
cab-las4/PC-w-... (no picture)  
(max. length 5m, outer jacket: PUR)



SI-RS232/Ethernet-4-...  
(length 0,5m, 1m, or 2m,  
outer jacket: PUR)



cab-las4/USB-... or  
cab-las4/USB-w-... (no picture)  
(each max. length 5m, outer jacket: PUR)





## Measuring Principle

### Measuring principle of color sensor SPECTRO-3-FIO-VISUV:

The SPECTRO-3 provides highly flexible signal acquisition. For example, the sensor can be operated in alternating-light mode (AC mode), which makes the sensor insensitive to extraneous light. It also can be set to constant-light mode (DC mode), which makes the sensor extremely fast and allows a scan-frequency of more than 30KHz.

An OFF function turns off the integrated light source at the sensor and changes to DC operation. The sensor then can detect so-called "self-luminous objects". In PULSE operation extremely dark surfaces can be reliably detected. With the stepless adjustment of the two integrated light sources and the selectable gain of the receiver signal the sensor can be set to almost any surface or any "self-luminous object".

When the two integrated light sources of the **SPECTRO-3-FIO-VISUV** color sensor is activated, the sensor detects the radiation that is diffusely reflected from the object. As a light source the **SPECTRO-3-FIO-VISUV** color sensor uses an internal white-light LED with adjustable transmitter power as well as an external UV or white light LED with also adjustable transmitter power. An integrated 3-fold receiver for the red, green, and blue content of the light that is reflected from the object, or the light that is emitted by a "self-luminous object", is used as a receiver. As mentioned above, a special feature here is that the gain of the receiver can be set in 8 steps. This makes it possible to optimally adjust the sensor to almost any surface and to different "self-luminous objects".

The SPECTRO-3 color sensor can be "taught" up to 31 colors. For each of these taught colors it is possible to set tolerances. In X/Y INT or s/i M mode these tolerances form a color cylinder in space. In X/Y/INT or s/i/M mode the tolerances form a color sphere in space. Color evaluation according to s/i M is based on the lab calculation method. All modes can be used in combination with several operating modes such as "FIRST HIT" and "BEST HIT". Raw data are represented with 12 bit resolution.

Color detection either operates continuously or is started through an external PLC trigger signal. The respective detected color either is provided as a binary code at the 5 digital outputs or can be sent directly to the outputs, if only up to 5 colors are to be detected. At the same time the detected color code is visualised by means of 5 LEDs at the housing of the SPECTRO-3. With a TEACH button at the sensor housing the color sensor can be taught up to 31 colors. For this purpose the corresponding evaluation mode must be set with the software. The TEACH button is connected in parallel to the input IN0 (green wire at cable cab-las8/SPS).

Parameters and measurement values can be exchanged between a PC and the SPECTRO-3 color sensor through the serial RS232 interface. All the parameters for color detection also can be saved to the non-volatile EEPROM of the SPECTRO-3 color sensor through this serial RS232 interface. When parameterisation is finished, the color sensor continues to operate with the current parameters in STAND-ALONE mode without a PC.

The sensors of the SPECTRO-3 series can be calibrated (white-light balancing). Balancing can be performed to any white surface. A ColorChecker™ table with 24 color fields is available as an alternative.



## Visualization

### Visualization of the color code:

The color code is visualised by way of 5 yellow LEDs at the housing of the SPECTRO-3 color sensor. At the same time in the binary mode (OUT BINARY) the color code indicated on the LED display is output as 5-bit binary information at the digital outputs OUT0 to OUT4 of the 8-pin SPECTRO-3/PLC socket.

The SPECTRO-3 color sensor is able to process a maximum of 31 colors (color code 0 ... 30) in accordance with the corresponding rows in the COLOR TEACH TABLE. An "error" respectively a "not detected color" is displayed by the lighting of all LED (OUT0 ... OUT4 digital outputs are set to HIGH-level).

In the DIRECT mode (OUT DIRECT HI or OUT DIRECT LO) the maximum numbers of colors to be taught is 5 (color no. 0, 1, 2, 3, 4). If DIRECT HI is activated, the specially digital output is set to HI, while the other 4 are set to LO. If the current color does not correspond with any of the teach-in colors, all digital outputs are set to LOW (no LED is lighting).

If DIRECT LO is activated, the specially digital output is set to LO, while the other 4 are set to HI. If the current color does not correspond with any of the teach-in colors, all digital outputs are set to HIGH (all LED are lighting).

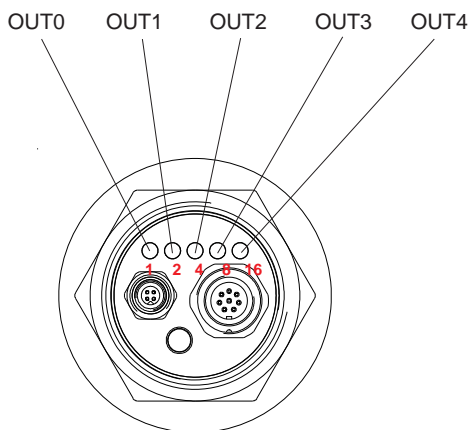
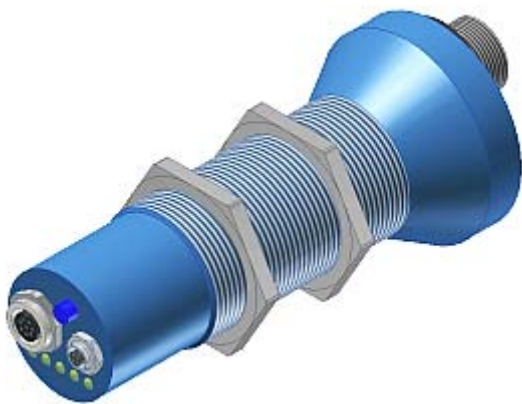


LED Display

**LED display:**

The color code is visualized by means of 5 yellow LEDs at the housing of the color sensor. At the same time the color code indicated at the LED display is output as 5-bit binary information at the digital outputs OUT0 ... OUT4 of the 8-pole PLC connector.

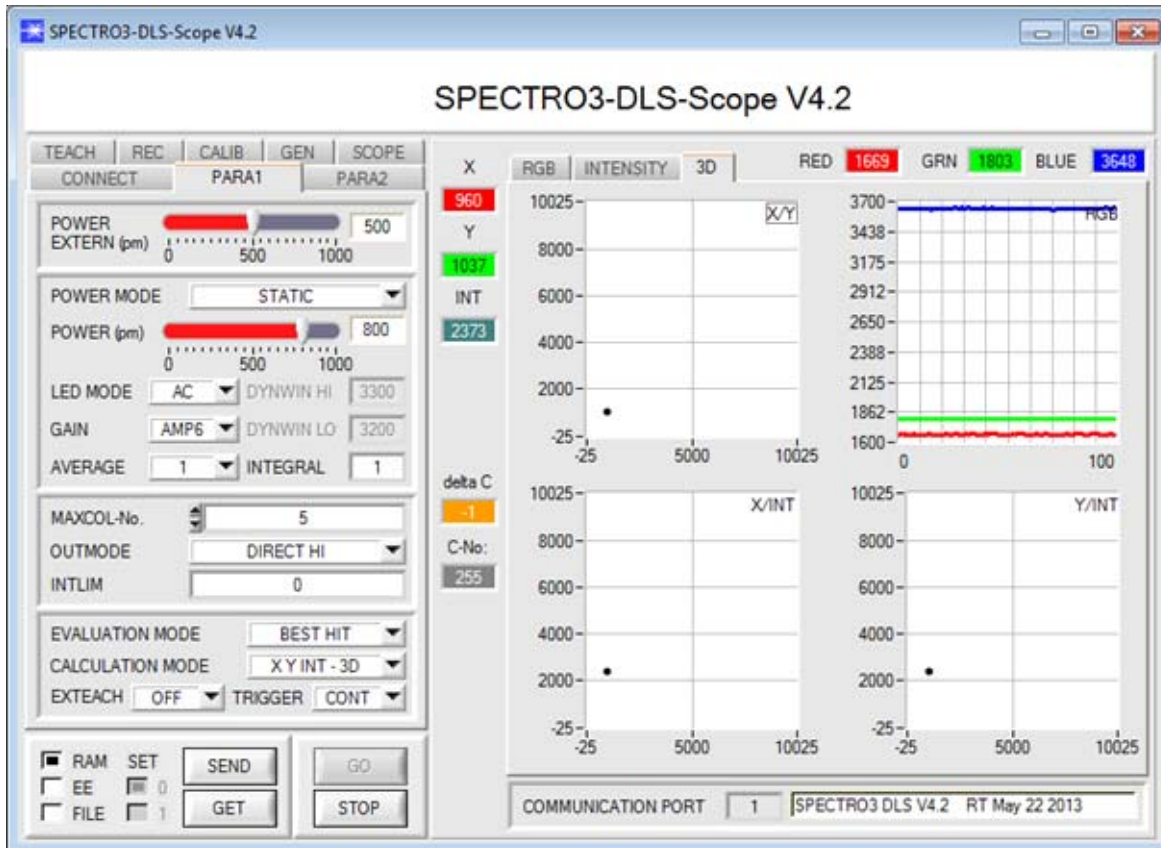
In the DIRECT mode the maximum number of color codes to be taught is 5. These 5 color codes can be directly output at the 5 digital outputs. The respective detected color code is displayed by means of the 5 yellow LEDs at the color sensor housing.



|                 |   |                 |
|-----------------|---|-----------------|
| ○ ○ ○ ○ ○<br>0  | ● ○ ○ ○ ○<br>1                          | ○ ● ○ ○ ○<br>2  |
| ● ● ○ ○ ○<br>3  | ○ ○ ● ○ ○<br>4                          | ● ○ ● ○ ○<br>5  |
| ○ ● ● ○ ○<br>6  | ● ● ● ○ ○<br>7                          | ○ ○ ○ ● ○<br>8  |
| ● ○ ○ ● ○<br>9  | ○ ● ○ ● ○<br>10                         | ● ● ○ ● ○<br>11 |
| ○ ○ ● ● ○<br>12 | ● ○ ● ● ○<br>13                         | ○ ● ● ● ○<br>14 |
| ● ● ● ● ○<br>15 | ○ ○ ○ ○ ●<br>16                         | ● ○ ○ ○ ●<br>17 |
| ○ ● ○ ○ ●<br>18 | ● ● ○ ○ ●<br>19                         | ○ ○ ● ○ ●<br>20 |
| ● ○ ● ○ ●<br>21 | ○ ● ● ○ ●<br>22                         | ● ● ● ○ ●<br>23 |
| ○ ○ ○ ● ●<br>24 | ● ○ ○ ● ●<br>25                         | ○ ● ○ ● ●<br>26 |
| ● ● ○ ● ●<br>27 | ○ ○ ● ● ●<br>28                         | ● ○ ● ● ●<br>29 |
| ○ ● ● ● ●<br>30 | ● ● ● ● ●<br>Error or<br>„not detected“ |                 |


 Parameterization
**Windows® user interface:**

The color sensor SPECTRO-3-FIO-VISUV is parameterized under Windows® with the SPECTRO3-DLS Scope (Double Light Source) software. The Windows® user interface facilitates the teach-in process at the color sensor and supports the operator in the task of adjustment and commissioning of the color sensor.



Under Windows® representation of the color value on a PC in numeric form and in a color chart, and representation of RGB values in a time chart. In addition the current RGB values are displayed as a bar chart.

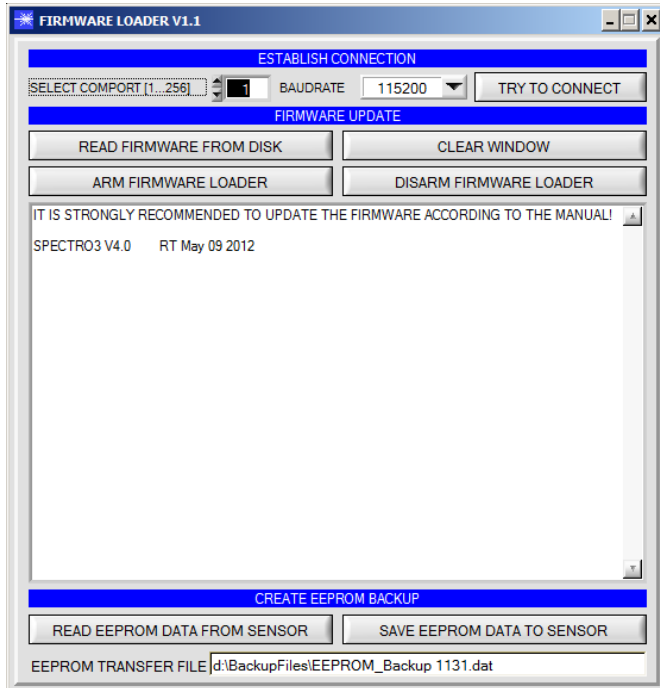
The RS232 interface (tab PARA1 or PARA2) is used for setting parameters such as:

- POWER EXTERN (pm) With this slider, a static transmitter power for a connected external light source can be set
- POWER MODE: Light power of the LED
- LED MODE: Triggering of the internal light source
- GAIN: Used for setting the gain of the receiver
- AVERAGE: Averaging over a maximum of 32768 values
- INTEGRAL: This function field is used to set the number of scan values (measurement values) over which the raw signal measured at the receiver is summed up. This integral function allows the reliable detection even of extremely weak signals
- MAXCOL-No.: Number of colors to be checked
- OUTMODE: Triggering of the digital outputs
- INTLIM: Minimum intensity required for color evaluation
- EVALUATION MODE: Various evaluation modes to choose from (FIRST HIT, BEST HIT, MIN DIST, COL5, THD RGB)
- CALCULATION MODE: There are 2 methods of teaching a color. The CALCULATION MODE X/Y/INT (or s/i/M) uses a color sphere in space with radius TOL. Contrary to this, the CALCULATION MODE X/Y INT (or s/i M) uses a color cylinder in space with radius CTO or siTO and with height ITO or M.
- EXTEACH: In all the evaluation modes teaching of a color can be performed externally through IN0 or by means of the button at the sensor housing
- TRIGGER: Continuous or external or self trigger



## Firmware Update

### Firmware Update by means of the software „Firmware Loader“:



The software „Firmware Loader“ allows the user to perform an automatic firmware update. The update will be carried out through the RS232 interface.

An initialisation file (xxx.ini) and a firmware file (xxx.elf.S) are required for performing a firmware update. These files can be obtained from your supplier. In some cases an additional firmware file for the program memory (xxx.elf.p.S) is also needed, and this file will be automatically provided together with the other two files.

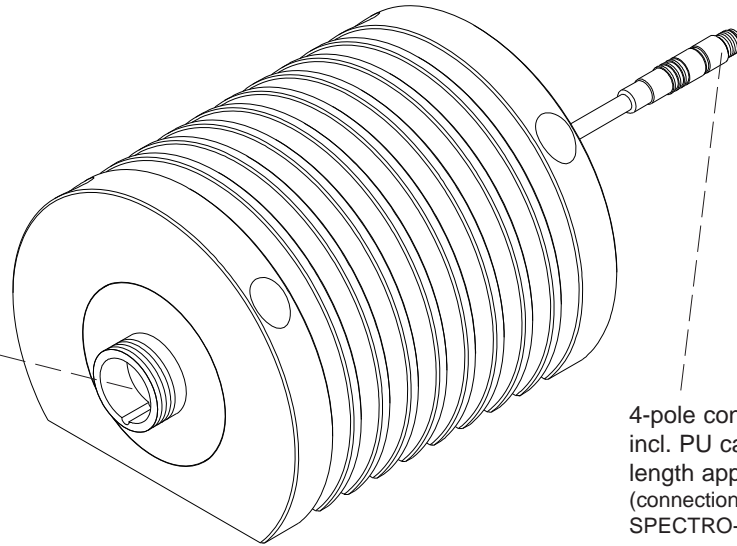


External UV Light Source

**SPECTRO-ELS-UV**

External UV light source (illumination unit)  
(please order separately)

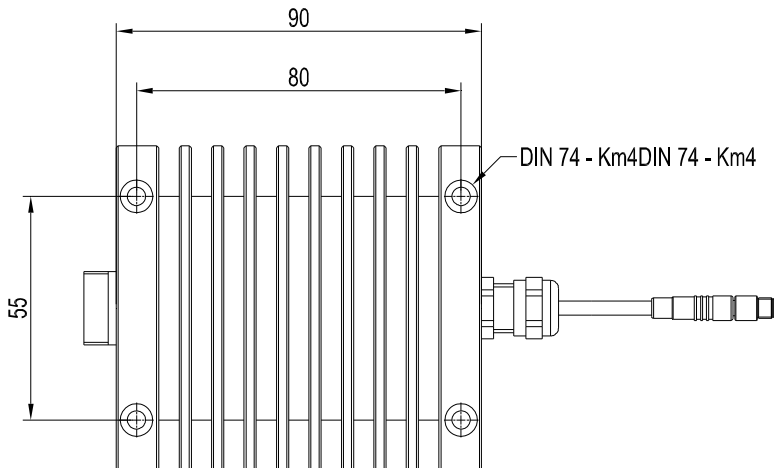
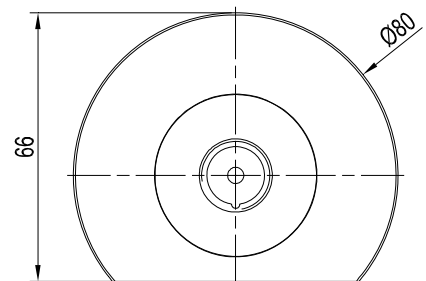
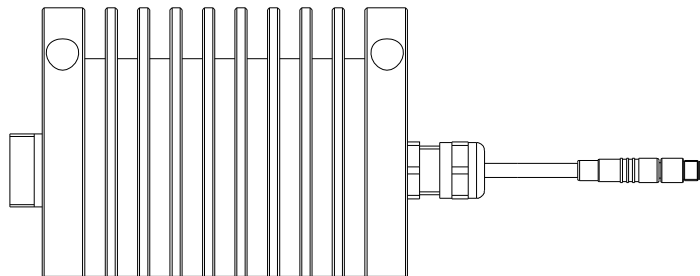
**ATTENTION!**  
Increased LED power!  
Do not look directly  
into the beam!



Fiber optics adapter (1-pole) for special fiber optics (Y-version), to choose:

- R-S-A1.1-(1.5)-1200-Y-22°/67°/67°-UV
  - R-S-A1.1-(1.5)-2000-Y-22°/67°/67°-UV
  - R-S-A2.0-(2.5)-1200-Y-22°/67°/67°-UV
  - R-S-A2.0-(2.5)-2000-Y-22°/67°/67°-UV
  - R-S-A3.0-(3.0)-1200-Y-22°/67°/67°-UV
  - R-S-A3.0-(3.0)-2000-Y-22°/67°/67°-UV
  - R-S-R1.1-(3x0.5)-1200-Y-22°/67°/67°-UV
  - R-S-R1.1-(3x0.5)-2000-Y-22°/67°/67°-UV
  - R-S-R2.1-(6x1)-1200-Y-22°/67°/67°-UV
  - R-S-R2.1-(6x1)-2000-Y-22°/67°/67°-UV
- (please order separately)

4-pole connector Binder 707  
incl. PU cable,  
length approx. 500 mm  
(connection to  
SPECTRO-3-FIO-VISUV)



All dimensions in mm



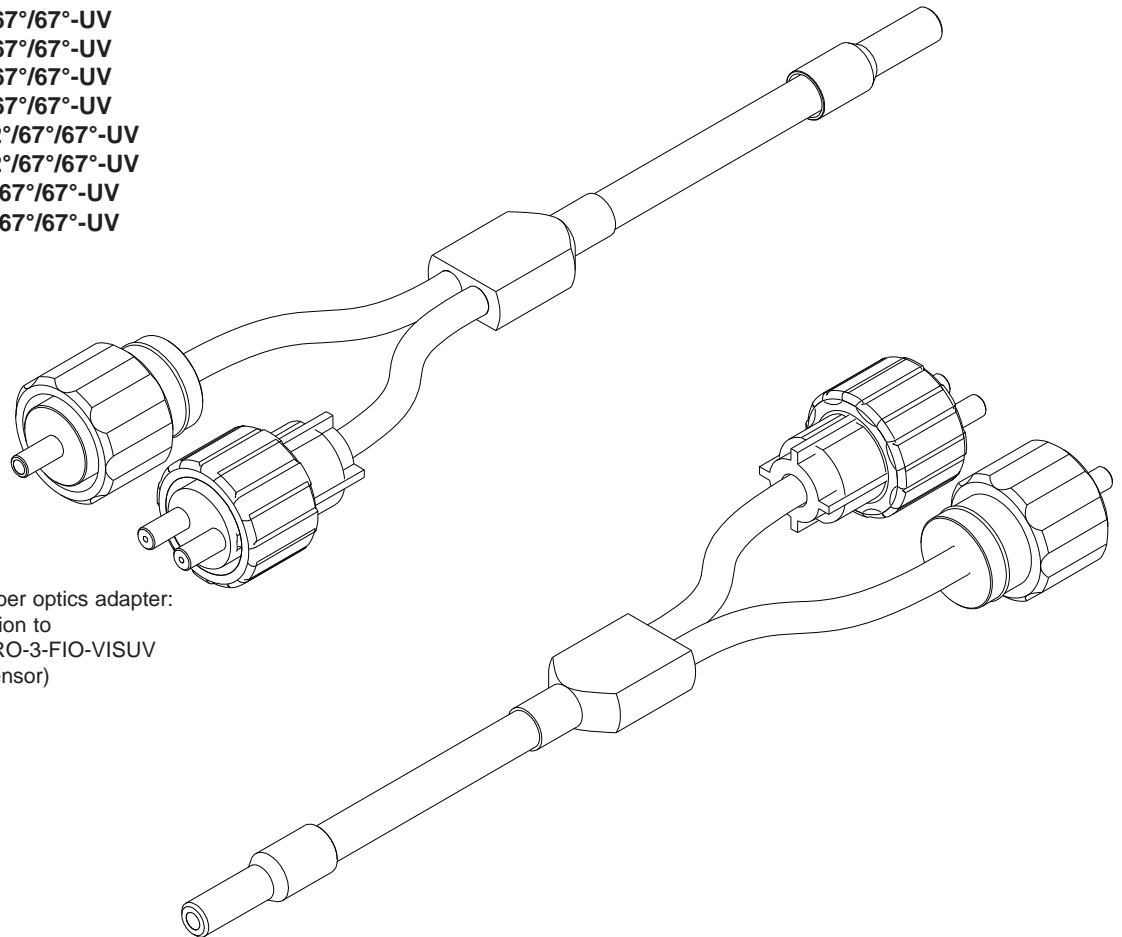
Special Fiber Optics

**Special fiber optics (reflected light fiber optics, Y-version)**  
**for use with external UV light source SPECTRO-ELS-UV:**  
 (please order separately)

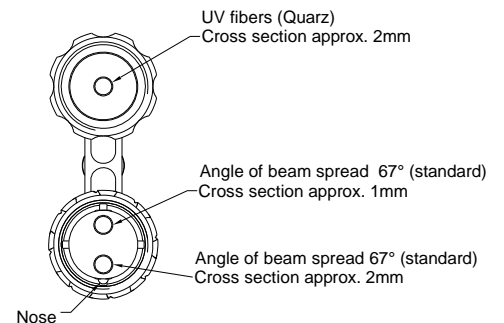
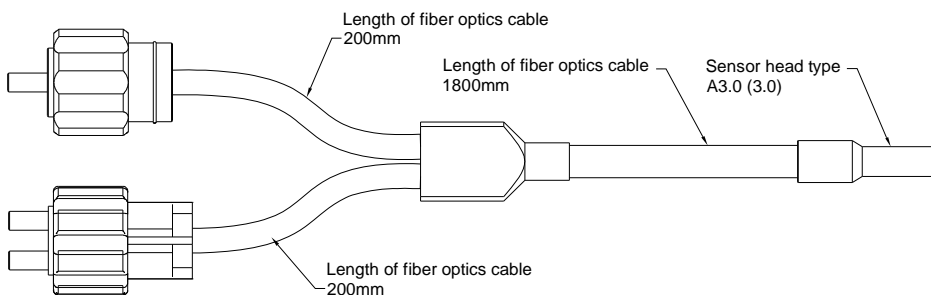
- R-S-A1.1-(1.5)-1200-Y-22°/67°/67°-UV
- R-S-A1.1-(1.5)-2000-Y-22°/67°/67°-UV
- R-S-A2.0-(2.5)-1200-Y-22°/67°/67°-UV
- R-S-A2.0-(2.5)-2000-Y-22°/67°/67°-UV
- R-S-A3.0-(3.0)-1200-Y-22°/67°/67°-UV
- R-S-A3.0-(3.0)-2000-Y-22°/67°/67°-UV
- R-S-R1.1-(3x0.5)-1200-Y-22°/67°/67°-UV
- R-S-R1.1-(3x0.5)-2000-Y-22°/67°/67°-UV
- R-S-R2.1-(6x1)-1200-Y-22°/67°/67°-UV
- R-S-R2.1-(6x1)-2000-Y-22°/67°/67°-UV

1-pole fiber optics adapter:  
 Connection to  
 SPECTRO-ELS-UV  
 (external UV light source)

2-pole fiber optics adapter:  
 Connection to  
 SPECTRO-3-FIO-VISUV  
 (color sensor)



Picture (example):  
 R-S-A3.0-(3.0)-(length)-Y-22°/67°/67°-UV





**Optical Frontends**

Optical frontends for UV fiber optics in Y-shape (22°/67°/67°-UV, for use with an external UV light source):

| Part number:   | Suitable for fiber optics type:<br>(R = reflected light) | Characteristics:                    |
|----------------|--|-------------------------------------|
| KL-3           | R-S-A2.0-(2.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 10 mm ... 20 mm  |
| KL-4           | R-S-A1.1-(1.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 10 mm ... 15 mm  |
| KL-5           | R-S-R1.1-(3x0.5)-...-Y-22°/67°/67°-UV                    | Working range typ. 8 mm ... 20 mm   |
| KL-8           | R-S-R2.1-(6x1)-...-Y-22°/67°/67°-UV                      | Working range typ. 8 mm ... 25 mm   |
| KL-9           | R-S-A3.0-(3.0)-...-Y-22°/67°/67°-UV                      | Working range typ. 8 mm ... 25 mm   |
| KL-M8-A1.1     | R-S-A1.1-(1.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 8 mm ... 20 mm   |
| KL-M12-A1.1    | R-S-A1.1-(1.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 8 mm ... 20 mm   |
| KL-M12-A2.0    | R-S-A2.0-(2.0)-...-Y-22°/67°/67°-UV                      | Working range typ. 8 mm ... 20 mm   |
| KL-M12-A3.0    | R-S-A3.0-(3.0)-...-Y-22°/67°/67°-UV                      | Working range typ. 8 mm ... 20 mm   |
| KL-M12-R1.1    | R-S-R1.1-(3x0.5)-...-Y-22°/67°/67°-UV                    | Working range typ. 8 mm ... 20 mm   |
| KL-M12-XL-A1.1 | R-S-A1.1-(1.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 30 mm ... 200 mm |
| KL-M12-XL-A2.0 | R-S-A2.0-(2.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 30 mm ... 200 mm |
| KL-M12-XL-R1.1 | R-S-R1.1-(3x0.5)-...-Y-22°/67°/67°-UV                    | Working range typ. 30 mm ... 200 mm |
| KL-M18-A1.1    | R-S-A1.1-(1.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 10 mm ... 60 mm  |
| KL-M18-A2.0    | R-S-A2.0-(2.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 10 mm ... 80 mm  |
| KL-M18-A3.0    | R-S-A3.0-(3.0)-...-Y-22°/67°/67°-UV                      | Working range typ. 10 mm ... 80 mm  |
| KL-M18-R1.1    | R-S-R1.1-(3x0.5)-...-Y-22°/67°/67°-UV                    | Working range typ. 10 mm ... 60 mm  |
| KL-M18-R2.1    | R-S-R2.1-(6x1)-...-Y-22°/67°/67°-UV                      | Working range typ. 10 mm ... 80 mm  |
| KL-M18-XL-A1.1 | R-S-A1.1-(1.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 50 mm ... 300 mm |
| KL-M18-XL-A2.0 | R-S-A2.0-(2.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 50 mm ... 300 mm |
| KL-M18-XL-A3.0 | R-S-A3.0-(3.0)-...-Y-22°/67°/67°-UV                      | Working range typ. 50 mm ... 300 mm |
| KL-M18-XL-R1.1 | R-S-R1.1-(3x0.5)-...-Y-22°/67°/67°-UV                    | Working range typ. 50 mm ... 300 mm |
| KL-M18-XL-R2.1 | R-S-R2.1-(6x1)-...-Y-22°/67°/67°-UV                      | Working range typ. 50 mm ... 300 mm |
| KL-M34-A1.1    | R-S-A1.1-(1.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 50 mm ... 200 mm |
| KL-M34-A2.0    | R-S-A2.0-(2.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 50 mm ... 250 mm |
| KL-M34-A3.0    | R-S-A3.0-(3.0)-...-Y-22°/67°/67°-UV                      | Working range typ. 50 mm ... 300 mm |
| KL-M34-R1.1    | R-S-R1.1-(3x0.5)-...-Y-22°/67°/67°-UV                    | Working range typ. 50 mm ... 200 mm |
| KL-M34-R2.1    | R-S-R2.1-(6x1)-...-Y-22°/67°/67°-UV                      | Working range typ. 50 mm ... 300 mm |
| KL-M34/62-A1.1 | R-S-A1.1-(1.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 80 mm ... 200 mm |
| KL-M34/62-A2.0 | R-S-A2.0-(2.5)-...-Y-22°/67°/67°-UV                      | Working range typ. 80 mm ... 200 mm |
| KL-M34/62-A3.0 | R-S-A3.0-(3.0)-...-Y-22°/67°/67°-UV                      | Working range typ. 80 mm ... 200 mm |
| KL-M34/62-R1.1 | R-S-R1.1-(3x0.5)-...-Y-22°/67°/67°-UV                    | Working range typ. 80 mm ... 200 mm |
| KL-M34/62-R2.1 | R-S-R2.1-(6x1)-...-Y-22°/67°/67°-UV                      | Working range typ. 80 mm ... 200 mm |



Optical Frontends

Overview: Optical frontends for reflected light UV fiber optics:



KL-3 (A2.0)  
KL-4 (A1.1)  
KL-5 (R1.1)  
KL-8 (R2.1)  
KL-9 (A3.0)



KL-M8-A1.1



KL-M12-A1.1  
KL-M12-A2.0  
KL-M12-A3.0  
KL-M12-R1.1



KL-M12-XL-A1.1  
KL-M12-XL-A2.0  
KL-M12-XL-R1.1



KL-M18-A1.1  
KL-M18-A2.0  
KL-M18-A3.0  
KL-M18-R1.1  
KL-M18-R2.1



KL-M18-XL-A1.1  
KL-M18-XL-A2.0  
KL-M18-XL-A3.0  
KL-M18-XL-R1.1  
KL-M18-XL-R2.1



KL-M34-A1.1  
KL-M34-A2.0  
KL-M34-A3.0  
KL-M34-R1.1  
KL-M34-R2.1



KL-M34-XL-A1.1  
KL-M34-XL-A2.0  
KL-M34-XL-A3.0  
KL-M34-XL-R1.1  
KL-M34-XL-R2.1

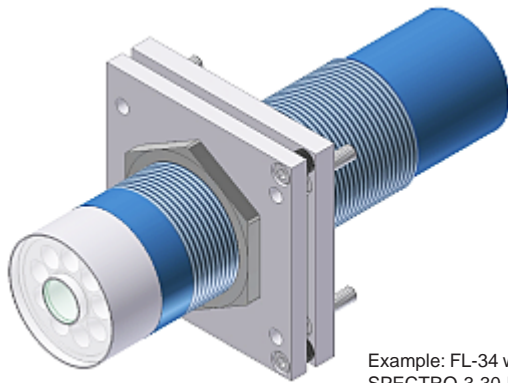
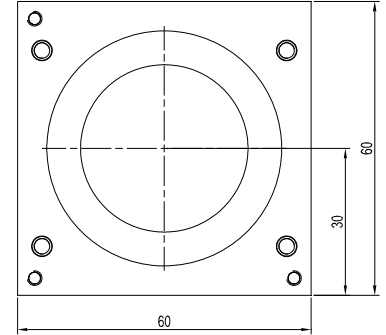
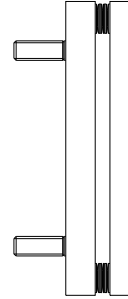
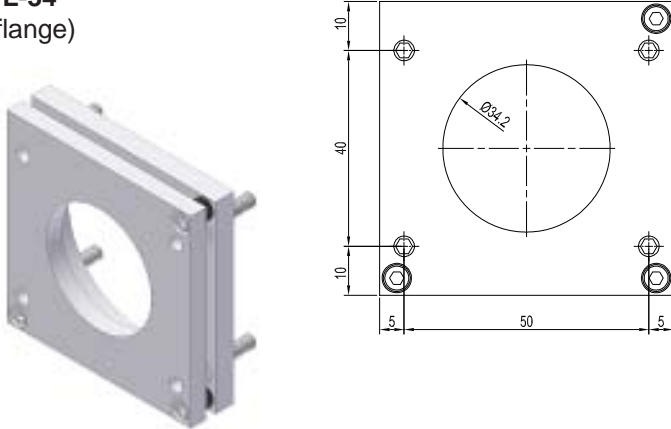


KL-M34/62-A1.1  
KL-M34/62-A2.0  
KL-M34/62-A3.0  
KL-M34/62-R1.1  
KL-M34/62-R2.1

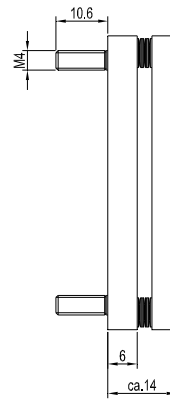


Mounting Accessories

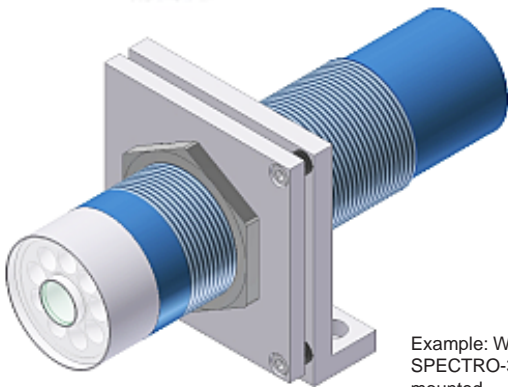
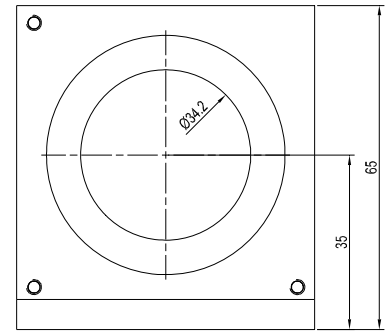
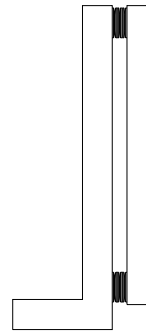
**FL-34**  
(flange)



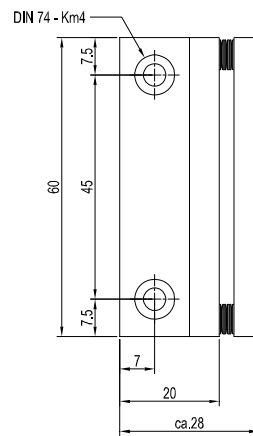
Example: FL-34 with  
SPECTRO-3-30-DIL  
mounted



**WFL-34**  
(flange, angle type 90°)



Example: WFL-34 with  
SPECTRO-3-30-DIL  
mounted



(All dimensions in mm)